



U.S. NUCLEAR REGULATORY COMMISSION

**STANDARD REVIEW PLAN**  
OFFICE OF NUCLEAR REACTOR REGULATION

7.6 INTERLOCK SYSTEMS IMPORTANT TO SAFETY

REVIEW RESPONSIBILITIES

Primary - Instrumentation and Control Systems Branch (ICSB)

Secondary - None

I. AREAS OF REVIEW

The areas reviewed in this section of the applicant's safety analysis report (SAR) include those interlock systems important to safety which operate to reduce the probability of occurrence of specific events or to maintain safety systems in a state to assure their availability in an accident. These systems include interlock systems to prevent overpressurization of low pressure systems (e.g., RHR) when these systems are connected to high pressure systems (e.g., primary coolant), interlocks to prevent overpressure of the primary coolant system during low temperature operation of the reactor vessel, valve interlocks to assure the availability of ECCS accumulators; interlocks to isolate safety systems from non-safety systems (e.g., seismic and non-seismic portions of auxiliary supporting systems), and interlocks to preclude inadvertent interties between redundant or diverse safety systems where such interties exist for the purposes of testing or maintenance.

The objectives of the review are to confirm that design considerations such as redundancy, independence, single failures, qualification, bypasses, status indication, and testing are consistent with the design bases of these systems and commensurate with the importance of the safety functions to be performed.

The review performed for a construction permit application may be based on preliminary designs and the depth of information need only be sufficient to provide reasonable assurance that the final design will conform to the design bases and applicable criteria with an adequate margin for safety. The review performed for an operating license (OL) application is based upon detailed design information that confirms that the final design conforms to the design bases and applicable criteria. The depth of the review for an OL application should be sufficient to conclude that the requirements of the Commission regulations have been satisfied. The depth of the review for the balance of the criteria should

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USNRC STANDARD REVIEW PLAN

Standard review plans are prepared for the guidance of the Office of Nuclear Reactor Regulation staff responsible for the review of applications to construct and operate nuclear power plants. These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required. The standard review plan sections are keyed to the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants. Not all sections of the Standard Format have a corresponding review plan.

Published standard review plans will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience.

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20555.

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be sufficient to conclude that the systems conform with the guidelines to the extent necessary to support the findings of conformance to the regulations.

This review is coordinated with primary review branches which have responsibility for the systems which interface with the interlock systems important to safety.

## II. ACCEPTANCE CRITERIA

The acceptance criteria and guidelines applicable to interlock systems are identified in SRP Section 7.1. The review of Section 7.1 of the SAR confirms that the appropriate acceptance criteria and guidelines have been identified as applicable for these systems. The review in this section of the SAR confirms that these systems conform to the requirements of the acceptance criteria and guidelines. The Branch Technical Positions are used when a particular design problem and an acceptable solution have been identified.

The acceptance criteria applicable for the review of interlock systems are:

1. General Design Criterion 13, "Instrumentation and Control."
2. General Design Criterion 19, "Control Room."

In addition to the acceptance criteria indicated above, the interlock systems important to safety are reviewed for conformance to the following acceptance criteria, where applicable, with regards to performance requirements commensurate with the importance of the safety function to be performed.

1. General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."
2. General Design Criterion 4, "Environmental and Missile Design Bases."

The following acceptance criteria are applicable to safety systems with which interlock systems may have an interface. These criteria are used as guidance, where applicable, in establishing the importance to safety for functions performed by interlock systems:

1. General Design Criterion 10, "Reactor Design."
2. General Design Criterion 15, "Reactor Coolant System Design."
3. General Design Criterion 16, "Containment Design."
4. General Design Criterion 28, "Reactivity Limits."
5. General Design Criterion 33, "Reactor Coolant Makeup."
6. General Design Criterion 34, "Residual Heat Removal."
7. General Design Criterion 35, "Emergency Core Cooling."
8. General Design Criterion 38, "Containment Heat Removal."
9. General Design Criterion 41, "Containment Atmosphere Cleanup."
10. General Design Criterion 44, "Cooling Water."

Regulatory Guides, Branch Technical Positions and industry standards that provide information, recommendations and guidance and in general describes a basis acceptable to the staff that may be used to implement the requirements of the Commission regulations identified above are given in SRP Section 7.1, Table 7-1 (Ref. 1) and SRP Appendix 7-A (Ref. 2). In addition, Task Action Plan items as identified in SRP Section 7.1, Table 7-2 (Ref. 3) are also implemented to meet the above regulations.

### III. REVIEW PROCEDURES

This subsection describes the general procedures to be followed in reviewing the interlock systems important to safety. The bases for the evaluation of conformance to the requirements of the acceptance criteria and guidelines may be based upon referenced approved designs. The category of referenced approved designs include topical reports, standard design approvals, and designs of systems which have been previously reviewed and approved by the Staff. If any aspect of a design is not identical to that which is referenced, an evaluation must be made to address the adequacy of the differences and the conclusions included in the safety evaluation report.

Review guidance for conformance to the GDC are provided in Appendix A of Section 7.1 (Ref. 4). The review guidance includes references to the guidelines in regulatory guides and industry codes and standards where applicable. An audit review of the interlock systems should be made to confirm that the systems conform to the guidelines to the extent necessary to support the conclusions of conformance to the regulations.

The interlock systems important to safety are reviewed as follows:

1. The interlocks to prevent overpressurization of low pressure systems are reviewed. Guidance for the review of this area is provided in BTP ICSB 3, "Isolation of Low Pressure Systems from the High Pressure Reactor Coolant System."
2. The interlocks to prevent overpressure of the primary coolant system during low temperature operations of this vessel are reviewed. Guidance for the review of this area is provided in BTP RSB 5-2.
3. The interlocks for ECCS accumulator valves are reviewed. Guidance for the review of this area is provided in BTP ICSB 4, "Requirements of Motor Operated Valves in the ECCS Accumulator Lines."
4. Any interlocks required to isolate safety systems from non-safety systems and any interlock required to preclude inadvertent interties between redundant or diverse safety systems are addressed on an individual case basis.

For those interlock systems for which the staff has taken the position that they should conform to the requirements of IEEE-279, review guidance is provided in Appendix B of SRP Section 7.1 (Ref. 5) for evaluating conformance.

The design basis for all interlock systems important to safety are reviewed to confirm the adequacy of the system design consistent with the importance to safety of the functions performed. Design considerations such as redundancy, independence, single failures, qualification, bypasses, status indication, and testing should be considered. To the extent applicable, the guidelines used

to demonstrate conformance to the acceptance criteria for safety systems may be used as a guide to address the adequacy of the design features for interlock systems important to safety.

An important part of the review is the engineering drawing review at the OL stage. The drawing review should confirm that the design and layout meet the applicable criteria listed under subsection II.

A site visit should be performed before the evaluation findings are written for an OL. The site visit should include an audit verification that the design and layout criteria reviewed during the drawing review are implemented. An outline of topics for a site visit is provided in Appendix 7-B (Ref. 6) to SRP Chapter 7.

In certain instances, it will be the reviewer's judgment that for a specific case under review, emphasis should be placed on specific aspects of the design, while other aspects of the design need not receive the same emphasis and indepth review. Typical reasons for such a nonuniform placement of emphasis are the introduction of new design features or the utilization in the design of design features previously reviewed and found acceptable. However, in all cases, the review must be sufficient to conclude conformance to the acceptance criteria, i.e., the requirements of the Commission's regulations.

#### IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided and the review supports conclusions of the following type, to be included in the staff's safety evaluation report:

The staff concludes that the design of the interlock systems important to safety are acceptable and meet the relevant requirements of General Design Criteria 2 and 4. This conclusion is based on the following:

The review of the interlock systems important to safety included the interlocks to prevent overpressurization of low pressure systems when connected to the primary coolant system. The staff position with regards to this interlock system is set forth in Branch Technical Position ICSB-3, "Isolation of Low Pressure Systems from the High Pressure Reactor Coolant System." Based on our review, we conclude that the design of this system satisfies the staff's guidelines.

Our review included the interlock provided to prevent overpressurization of the primary coolant system during low temperature operation. The staff's position with regards to this interlock system is set forth in Branch Technical Position RSB 5-2, "Overpressurization Protection of Pressurized Water Reactors While Operating at Low Temperatures." Based on our review we conclude that the design of this system satisfies the staff's guidelines.

Our review included the interlock for the ECCS accumulator valves. The staff's position with regards to this interlock system is set forth in Branch Technical Position ICSB 4, "Requirements of Motor Operated Valves in the ECCS Accumulator Lines." Based on our review we conclude that these interlocks satisfy the staff's guidelines.

Based on our review of the interlock systems important to safety, we conclude that their design bases is consistent with the plant safety analysis and the systems importance to safety. Further, we conclude that the aspects of the design of those systems with respect to single failures, redundancy, independence, qualification and testability are adequate to assure that the functional performance requirements of these systems will be met and meet the applicable requirements of GDC 2 and 4. The applicant has also incorporated into the system design the recommendations of Task Action Plan item [identify item number and how implemented] which we have reviewed and found acceptable.

The conclusions noted above for the interlock systems important to safety are applicable to all portions of the systems except for the following for which acceptance is based upon prior Commission review and approval as noted: [List applicable system or topics and identify references]

## **V. IMPLEMENTATION**

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP section.

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides and NUREGs.

## **VI. REFERENCES**

1. Standard Review Plan Section 7.1, Table 7-1, "Acceptance Criteria and Guidelines for Instrumentation and Control Systems Important to Safety."
2. Standard Review Plan Appendix 7-A, "Branch Technical Positions (ICSB)."
3. Standard Review Plan Section 7.1, Table 7-2, "TMI Action Plan Requirements for Instrumentation and Control Systems Important to Safety."
4. Standard Review Plan Section 7.1, Appendix A, "Acceptance Criteria and Guidelines for Instrumentation and Control Systems Important to Safety."
5. Standard Review Plan Section 7.1, Appendix B, "Guidance for Evaluation of Conformance to IEEE Std 279."
6. Standard Review Plan Appendix 7-B, "General Agenda, Station Site Visits."